

REMARKS

In view of the following remarks, reevaluation and further processing of the application is requested. Prior to amendment herewith, Claims 1-3 were pending in the application and Claim 4-15 had been cancelled. By amendment herewith, Claim 1 has been amended, Claim 3 has been cancelled, and Claims 16-30 have been added.

In the Office Action, the Examiner rejected Claims 1-3 under 35 U.S.C. 103 as being obvious in view of U.S. Patent No. 4,076,727 to Zey et al. ("Zey"). The Examiner states that Zey differs from the present invention in that the present invention has added provisions for operating outside of the scope of Zey. The Examiner further states that although Zey does not disclose thioacetals, based on the state of art for preparing (meth)acrylic comprising cyclic acetal/thioacetal, a polymer chemist of ordinary skill in the art would be motivated to modify Zey by preparing (meth)acrylic comprising thioacetal. The Examiner further states that such a modification would be obvious because one would have a reasonable expectation of success that acetals taught by Zey would be similarly useful and applicable to thioacetal because oxygen and sulfur are in the same chemical family and have similar chemical reactivity. Applicant respectfully traverses this rejection.

To establish a *prima facie* case of obviousness, three basic criteria must be met:

1. There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;
2. There must be a reasonable expectation of success; and
3. The prior art reference (or references when combined) must teach or suggest all the claim limitations.

MPEP § 2143. Further, in chemical composition cases, the Federal Circuit has held that the mere possibility that one chemical component could be modified or replaced such that it leads to the claimed chemical compound does not make the chemical compound obvious "unless the prior art suggested the desirability of such a modification or replacement." In re Brouwer, 77 F.3d 422, 425 (Fed. Cir. 1995).

Here, Zey provides no suggestion that his composition could be modified using thioacetals instead of acetals. As admitted by the Examiner, Zey does not suggest the use of thioacetals. Indeed, Zey discloses that the process for preparing his compositions involves:

[F]orming the cyclic alcohol by coreacting polyols selected from the group consisting of glycerin, trimethylolpropane, and trimethylolethane, with an aldehyde selected from formaldehyde (formalin) or any of the C₂-C₄ aldehydes or halogenated aldehydes, including butyraldehyde and formaldehyde, and coreacting the alcohol with acrylic or methacrylic acid. (Col. 1, lines 64-68 and Col. 2, lines 1-3)

Zey discloses that the first step in his synthesis is:

[C]oreacting an aldehyde selected from the group consisting of formaldehyde and the C₂-C₄ aldehydes or halogenated aldehydes with a tri-alcohol selected from the group consisting of trimethylolpropane, trimethylolethane, and a glycerin derivative. (Col. 2, lines 13-20).

Zey does not teach or suggest that a thiol may be used to replace the alcohol precursor, which would be a prerequisite for thioacetal formation. Thus, Zey does not provide the requisite suggestion to modify, and therefore cannot be used as a basis to reject the present invention under 35 U.S.C. § 103 per In re Brouwer.

Moreover, to one of average skill in the art, acetals and thioacetals are not chemically equivalent. For example, one organic chemistry text notes that conditions useful in acetal hydrolysis are not useful in thioacetals hydrolysis:

Although acetals, ketals, and ortho esters are easily hydrolyzed by acids, they are extremely resistant to hydrolysis by bases . . . Thioacetals(RCH)SR₂ and thioketals are among those compounds generally resistant to acid hydrolysis.

March, Jerry, *Advanced Organic Chemistry*, 3rd Ed., (1985), John Wiley & Sons, pp. 331. (Copy attached in Appendix A).

Additionally, and contrary to the Examiner's position that "oxygen and sulfur are in the same chemical family and have similar chemical reactivity", it is widely recognized that oxygen properties are very different from sulfur properties. For example, it is noted in one inorganic chemistry text that:

Oxygen stands apart in many physical and chemical properties [from the other Group VIB elements], with close similarities between S, Se, and Te.

Douglas et al., *Concepts and Models of Inorganic Chemistry*, 3rd Ed., (1994), John Wiley & Sons., pp. 773. (Copy attached in Appendix B).

Furthermore, Zey does not suggest the use of thioacetals or acetals in combination with the chemical groups defined by R₂. Indeed, Zey only discloses the use of small-chained CH₂ or

CH₂O groups with cyclical acetals, and provides no suggestion, disclosure or teaching of other connecting groups outside of this scope. Applicant's R₂ groups do not read on Zey, as CH₂ and CH₂O are specifically excluded from R₂ when the X₁ and X₂ are both oxygen. To more clearly present such a limitation, Applicant has amended Claim 1. More particularly, Applicant has amended the provisos of (a), (b), and (c) to make clear that when R₂ is CH₂, or a small chain thereof, or R₂ is CH₂O, or a small chain thereof, or R₂ is simply oxygen (O), then one of X₁ and X₂ must be sulfur (S). If none of (a), (b) or (c) apply, then R₂ and X₁ and X₂ can be as previously stated in the claim. Surely, Zey does not teach a monomer connecting a carbonyl group to a cyclical group utilizing the claimed R₂ groups. Moreover, Zey provides no teaching, suggestion or disclosure that would motivate one of ordinary skill in the art to utilize the claimed R₂ groups. In view of the foregoing, it is submitted that the present invention is not obvious to those skilled in the art.

As noted, Applicant has also added new claims 16-30, which are also related to the monomer (I). Any necessary additional claim fees are calculated below.

For	Claims Remaining After Amendment	Highest Number Previously Paid For		Extra Claims	Rate		Additional Fee
Total Claims	17	- 20	=	0	x \$50	=	\$0
Independent Claims	2	- 3	=	0	x \$200	=	\$0
Multiple Dep. Claim	0	- 0		\$360		=	\$0
Total Fee						=	\$0

In light of the above remarks, it is believed that all claims in the application are now in condition for allowance, and such action is respectfully requested. Should any additional issues need to be resolved, the Examiner is invited to telephone the undersigned to attempt to resolve those issues.

Respectfully submitted,

September 15, 2006

Date

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PATENT TRADEMARK OFFICE

APPENDIX “A”

ADVANCED ORGANIC CHEMISTRY

REACTIONS,
MECHANISMS, AND
STRUCTURE

THIRD EDITION

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A Wiley-Interscience Publication

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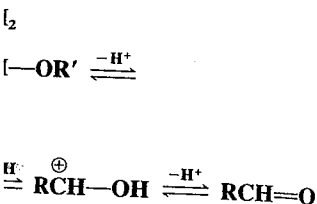
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ons therefore proceed by the S_N1

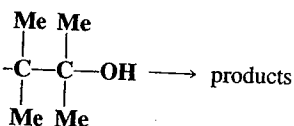


erse of that for acetal formation
upporting the mechanism are:³⁸⁶

(2) It is faster in D_2O . (3)
cohol the R—O bond does not
enone ketals, the intermediate

ons (SO_3^{2-}).³⁸⁸ (6) Trapping of
step must come earlier. (7) In
were isolated as stable ions in
.³⁸⁹ (8) Hydrolysis rates greatly
OR'), as would be expected
formation of **91** is usually the
hat at least in some cases this
protonated hemiacetal.³⁹⁰

hydrolyses, it has been shown
substrates.³⁹¹ In one of these
o that the mechanism is S_N2cA
2-(*p*-methoxyphenyl)-4,4,5,5-



Chem., Ref. 383.

c. Chem. Res. **13**, 161–169 (1980);
, and Rietz, J. Am. Chem. Soc. **102**,

nashev, Yasman, and Rakhmankulov,

lland, J. Org. Chem. **45**, 644 (1980);

Wann and Kreevoy, J. Org. Chem.

J. Chem. Soc., Perkin Trans. 2 **357**

In the second mechanism, the first and second steps are concerted. In the case of hydrolysis of 2-(*p*-nitrophenoxy)tetrahydropyran, general acid catalysis was shown,³⁹³ demonstrating that the substrate is protonated in the rate-determining step (p. 227). Reactions in which a substrate is protonated in the rate-determining step are called A-SE2 reactions.³⁹⁴ However, if protonation of the substrate were all that happens in the slow step, then the proton in the transition state would be expected to lie closer to the weaker base (p. 227). Because the substrate is a much weaker base than water, the proton should be largely transferred. Since the Brönsted coefficient was found to be 0.5, the proton was actually transferred only about halfway. This can be explained if the basicity of the substrate is increased by partial breaking of the C—O bond. The conclusion is thus drawn that steps 1 and 2 are concerted. The hydrolysis of ortho esters in most cases is also subject to general acid catalysis.³⁹⁵

A particularly convenient reagent for acetals is wet silica gel.³⁹⁶ Ketals can be converted to ketones under nonaqueous conditions by treatment with Me_3SiI in CH_2Cl_2 or $CHCl_3$.³⁹⁷ Both acetals and ketals can be hydrolyzed with $LiBF_4$ in wet MeCN.³⁹⁸

Although acetals, ketals, and ortho esters are easily hydrolyzed by acids, they are extremely resistant to hydrolysis by bases. An aldehyde or ketone can therefore be protected from attack by a base by conversion to the acetal or ketal (**6-6**), and then can be cleaved with acid. Thioacetals, thioketals, gem-diamines, and other compounds that contain any two of the groups OR, OCOR, NR_2 , NHCOR, SR, and halogen on the same carbon can also be hydrolyzed to aldehydes or ketones, in most cases, by acid treatment. Thioacetals $RCH(SR'_2)$ and thioketals $R_2C(SR'_2)$ are among those compounds generally resistant to acid hydrolysis. Because conversion to these compounds (**6-11**) serves as an important method for protection of aldehydes and ketones, many methods have been devised to cleave them to the parent carbonyl compounds. Among reagents³⁹⁹ used for this purpose are $HgCl_2$,⁴⁰⁰ $HgO-BF_3$,⁴⁰¹ H_2O_2-HCl ,⁴⁰² $t\text{-BuBr-Me}_2SO$,⁴⁰³ PbO_2-BF_3 -etherate,⁴⁰⁴ $Me_2SO-HCl$ -dioxane,⁴⁰⁵ and benzeneseleninic anhydride $(PhSeO)_2O$.⁴⁰⁶

Enol ethers are readily hydrolyzed by acids; the rate-determining step is protonation of the substrate. However, protonation does not take place at the oxygen but at the β -carbon,⁴⁰⁷ because

³⁹³Fife and Jao, J. Am. Chem. Soc. **90**, 4081 (1968); Fife and Brod, J. Am. Chem. Soc. **92**, 1681 (1970). For other examples, see Kankaanperä and Lahti, Acta Chem. Scand. **23**, 2465 (1969); Anderson and Capon, J. Chem. Soc. B **1033** (1969); Anderson and Fife, J. Am. Chem. Soc. **93**, 1701 (1971); Mori and Schaleger, J. Am. Chem. Soc. **94**, 5039 (1972); Capon and Nimmo, J. Chem. Soc., Perkin Trans. 2 **1113** (1975); Eliason and Kreevoy, J. Am. Chem. Soc. **100**, 7037 (1978); Jensen, Herold, Lenz, Trusty, Sergi, Bell, and Rogers, J. Am. Chem. Soc. **101**, 4672 (1979).

³⁹⁴For a review of A-SE2 reactions, see Williams and Kreevoy, Adv. Phys. Org. Chem. **6**, 63–101 (1968).

³⁹⁵See Bergstrom, Cashen, Chiang, and Kresge, J. Org. Chem. **44**, 1639 (1979); Ahmad, Bergstrom, Cashen, Chiang, Kresge, McClelland, and Powell, J. Am. Chem. Soc. **101**, 2669 (1979); Burt, Chiang, Kresge, and McKinney, J. Am. Chem. Soc. **104**, 3685 (1982); Chiang, Kresge, Lahti, and Weeks, J. Am. Chem. Soc. **105**, 6852 (1983); Santry and McClelland, J. Am. Chem. Soc. **105**, 6138 (1983).

³⁹⁶Huet, Lechevallier, Pellet, and Conia, Synthesis **63** (1978).

³⁹⁷Jung, Andrus, and Ornstein, Tetrahedron Lett. **4175** (1977). See also Morita, Okamoto, and Sakurai, Bull. Chem. Soc. Jpn. **54**, 267 (1981). Balme and Goré, J. Org. Chem. **48**, 3336 (1983).

³⁹⁸Lipshutz and Harvey, Synth. Commun. **12**, 267 (1982).

³⁹⁹For references to other reagents, see Gröbel and Seebach, Synthesis 357–402 (1977), pp. 359–367; Cussans, Ley, and Barton, J. Chem. Soc., Perkin Trans. 1 **1654** (1980).

⁴⁰⁰Corey and Erickson, J. Org. Chem. **36**, 3553 (1971).

⁴⁰¹Vedejs and Fuchs, J. Org. Chem. **36**, 366 (1971).

⁴⁰²Olah, Narang, and Salem, Synthesis **657**, 659 (1980).

⁴⁰³Olah, Mehrotra, and Narang, Synthesis **151** (1982).

⁴⁰⁴Ghiringhelli, Synthesis **580** (1982).

⁴⁰⁵Prato, Quintily, Scorrano, and Sturaro, Synthesis **679** (1982).

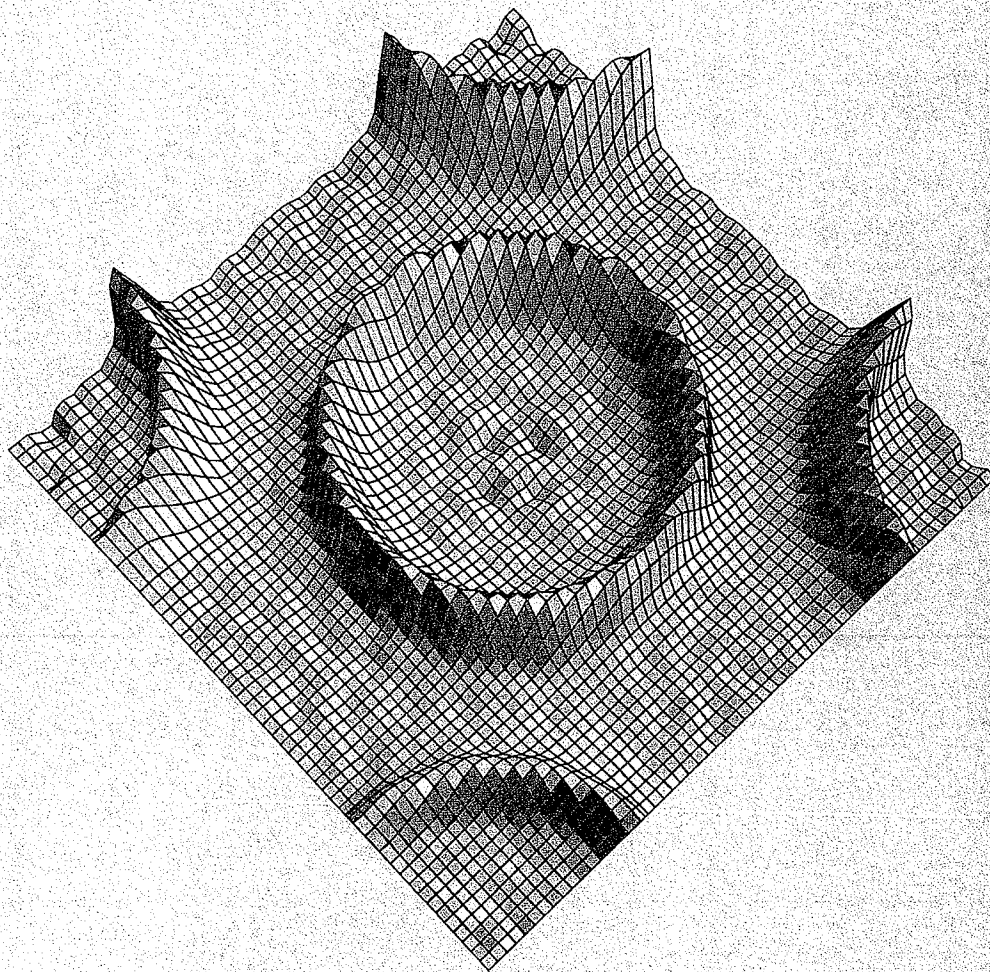
⁴⁰⁶Cussans, Ley, and Barton, Ref. 399.

⁴⁰⁷Jones and Wood, J. Chem. Soc. **5400** (1964); Okuyama, Fueno, Nakatsuji, and Furukawa, J. Am. Chem. Soc. **89**, 5826 (1967); Okuyama, Fueno, and Furukawa, Bull. Chem. Soc. Jpn. **43**, 3256 (1970); Kreevoy and Eliason, J. Phys. Chem. **72**, 1313 (1969); Lienhard and Wang, J. Am. Chem. Soc. **91**, 1146 (1969); Kresge and Chen, J. Am. Chem. Soc. **94**, 2818 (1972); Burt, Chiang, Kresge, and Szilagyi, Can. J. Chem. **62**, 74 (1984).

APPENDIX “B”

CONCEPTS AND MODELS OF INORGANIC CHEMISTRY

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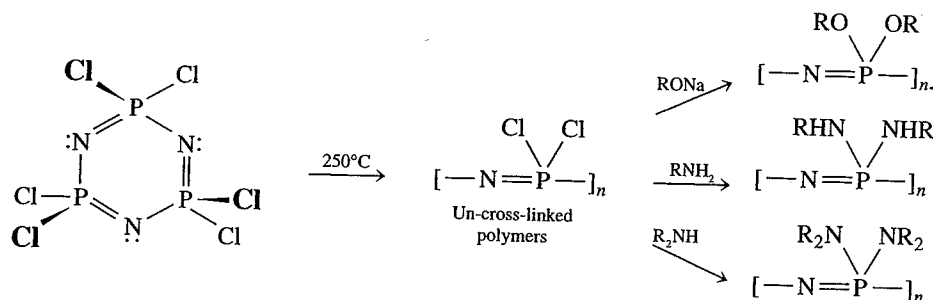
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Scheme 16.2 Polyphosphazenes

polymers are (a) glasses, (b) elastomers that retain their elasticity at low temperature and are oil-resistant, (c) film-forming polymers, and (d) polymers that can be fabricated into fibers. Some of the polymers are water-repellant and compatible with living tissue for use in biomedical devices. Those derived from amino acid esters are biodegradable into harmless products through hydrolysis. The polymers can be modified by chemical reactions to produce adhesive, biocompatible, and even antibacterial surfaces.

16.3 OXYGEN, SULFUR, AND SELENIUM

► 16.3.1 Family Trends

Some properties of the elements of the oxygen family (chalcogens) are listed in Table 16.3. Oxygen stands apart in many physical and chemical properties, with close similarities among S, Se, and Te. A major difference is that third-period (and later) elements have *d* orbitals available for *pm**d* bonding or for the expansion of the valence shell beyond the octet. There are no oxygen counterparts of SF₄ and SF₆. Thus for Groups 15–17 we have a big change in properties from the first member of each group to the next, but a very small change from the second member to the third. Within each main-group family to the right of the transition series, the pairs Al and Ga, Si and Ge, P and As, S and Se, and Cl and Br display the greatest similarities, because of their equivalent sets of valence shell or-

Table 16.3 Some properties of group 16 (VIB) elements

	O	S	Se	Te	Po
Crystal radius (X^{2-} , pm)	126	170	184	207	—
Covalent radius (pm)	74	103	118	142	—
Electronegativity	3.4	2.6	2.6	2.1	2.0
First ionization (MJ/mol)	1.3140	0.99960	0.9409	0.8693	0.812
energy (eV)	13.62	10.360	9.752	9.009	8.42
Electron affinity (kJ/mol)	141.0	200.43	194.99	190.16	180
Outer electron configuration	$2s^2 2p^4$	$3s^2 3p^4$	$3d^{10} 4s^2 4p^4$	$4d^{10} 5s^2 5p^4$	$4f^{14} 5d^{10} 6s^2 6p^4$